CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] It shall be the glass substrate by which chemical strengthening was carried out, and the depth of the compressive stress layer produced on a glass substrate surface by chemical strengthening shall be 30-100 micrometers. The glass substrate for recording media characterized by the value of the tensile stress which makes the value of compressive stress 2-15kg/mm2 or less, and is produced inside a glass substrate by chemical strengthening being 1.5kg/mm2 or less.

[Claim 2] The glass substrate for recording media according to claim 1 with which glass composition of a glass substrate is characterized by being the composition which contains Al2O3 for ZnO2 0 to 2.8% 57 to 74%, and contains [SiO2] Na2O for LiO2 4 to 14% 7 to 16% 3 to 15% by a mol % displays.

[Claim 3] The glass substrate for recording media according to claim 1 or 2 characterized by immersing chemical strengthening of a glass substrate in chemical-strengthening-treatment liquid with a temperature of 200-500 degrees C for 0.5 to 5 hours, and performing it.

[Claim 4] The glass substrate for recording media according to claim 1 to 3 characterized by having ground the end face of the glass substrate and removing the crack leading to breakage with the passage of time.

[Claim 5] The glass substrate for recording media according to claim 4 characterized by the polishing quantity of the end face of a glass substrate being 0.5-15 micrometers.

[Claim 6] The glass substrate for recording media according to claim 5 characterized by making the end polishing of a glass substrate with a brush, abrasive powder (polisher), or abrasive powder.

[Claim 7] The glass substrate for recording media according to claim 4 to 6 characterized by the surface roughness of the end face of a glass substrate being Rmax:0.01-1micrometer and Ra:0.001-0.8micrometer.

[Claim 8] The recording medium characterized by forming a recording layer at least on the glass substrate for recording media according to claim 1 to 7.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the recording medium which used glass substrates for recording media, such as a computer, and the substrate of those.

[0002]

[Description of the Prior Art] Although the aluminum substrate has been widely used as substrates for magnetic recording media, such as a magnetic disk, the glass substrate which was excellent in intensity, flat nature, etc. compared with the aluminum substrate is gradually replaced with the small size and thin-board-izing of a magnetic disk, and the formation of high-density record.

[0003] This has characteristics, like a glass substrate has sufficient hardness which can respond to the byway and thin board-ization of the latest hard disk. It is because it is suitable to have the character to excel also in a physical variance and chemical durability, and to be able to form the surface in high plane accuracy comparatively easily moreover, therefore for a spacing to be made small, and to be easy to attain low floatation run-ization of a magnetic head with high-density record-ized realization.

[0004] Moreover, chemical strengthening treatment of the surface of a glass substrate is carried out in many cases in order to raise the intensity of a glass substrate further.

[0005] In detail, when using a glass substrate as a substrate for magnetic disks, it is the purpose which prevents that raise shock resistance and vibration resistance nature and a substrate is damaged by a shock or vibration, and chemical strengthening treatment by an ion exchange (low temperature) method is performed to the surface of a glass substrate in many cases.

[0006] Chemical strengthening treatment is processing which replaces Li in glass, Na ion, etc. by ion exchange with Na with a larger ionic radius than them, K ion, etc., generates compressive stress strong against a glass surface layer, for example, and increases intensity.

[0007] If the compressive stress layer produced in the surface part of a glass substrate by chemical strengthening treatment is thickened too much with thin-board-izing of a glass substrate, big tensile stress occurring and inviting strong lowering to the inside of a glass substrate is known (JP,H7-230621,A). In this gazette, the thickness of the compressive stress layer supposes that it is desirable to carry out within the limits of 5-25 micrometers.

[0008] Moreover, the depth of the crack to which an applicant for this patent usually exists in a glass substrate surface, The depth of the compressive stress layer of the glass substrate surface by chemical strengthening is coincided mostly, and it is applying about the technology which raises intensity and endurance because the maximum of the tensile stress produced inside a glass substrate shall be 4kg/mm2 or less further (JP,H2-31325,A).

[0009]

[Problem to be solved by the invention] Thin board-ization of a glass substrate brings about lowering of the intensity of a glass substrate relatively compared with the case of being thick. Therefore, it requires that control of the affecting factor is more important for the intensity of a glass substrate than before, and it is strict.

[0010] However, there is a problem that the conventional glass substrate has inadequate control of the factor which affects the intensity of a glass substrate when it thin-board-izes.
[0011] This invention is made in view of the above-mentioned trouble, controls strictly the factor which affects the intensity of a glass substrate in the optimal range, and sets offer of the glass substrate for recording media which aimed at improvement of endurance to intensity and breakage with the passage of time as the first purpose.
[0012] Moreover, offer of a recording medium excellent in intensity and the endurance over breakage with the passage of time is set as the second purpose.
[0013]
[Means for solving problem] The compressive stress produced when chemical strengthening of the glass substrate is carried out as a result of this invention persons' repeating investigation wholeheartedly, in order to attain the above-mentioned purpose, When the balance of three persons of tensile stress and the depth of a compressive stress layer was bad, it found out that breakage (breakage produced by using it over a long period of time) with the passage of time might be caused, and it found out that it was required to make three persons balance strictly by moderate chemical strengthening. And it found out that the intensity of a glass substrate and the endurance over breakage with the passage of time improved remarkably by controlling three persons in the optimal range strictly.
[0014] Furthermore, the crack of the end face prevented lowering of the intensity generated owing to, the durable lowering to breakage with the passage of time, etc. by removing the crack which exists in the end face of a glass substrate by polish, and it finds out that improvement of endurance to intensity and breakage with the passage of time is achieved further, and came to complete this invention.
[0015] [namely, the glass substrate for recording media of this invention] It shall be the glass substrate by which chemical strengthening was carried out, and the depth of the compressive stress layer produced on a glass substrate surface by chemical strengthening shall be 30-100 micrometers. It has composition which made the value of the tensile stress which makes the value of compressive stress 2-15kg/mm2 or less, and is produced inside a glass substrate by chemical strengthening 1.5kg/mm2 or less.
[0016] Moreover, in the glass substrate for recording media of above-mentioned this invention, the glass composition of a glass substrate the glass substrate for recording media of this invention [a mol % displays] For ZnO2 Al2O3 0 to 2.8% 57 to 74% 3 to 15%, [SiO2] The end face of composition and a glass substrate which immerses the composition which is the composition which contains Na2O for LiO2 4 to 14% 7 to 16%, and chemical strengthening of a glass substrate for 0.5 to 5 hours in chemical-strengthening-treatment liquid with a temperature of 200-500 degrees C, and performs them is ground. [the polishing quantity of the end face of composition and a glass substrate which removed the crack leading to breakage with the passage of time] It has composition which is 0.5-15 micrometers, composition with which the end polishing of a glass substrate is made with a brush, abrasive powder (polisher), or abrasive powder, or composition whose surface roughness of the end face of a glass substrate is Rmax:0.01-1micrometer and Ra:0.001-0.8micrometer.

[0017] Furthermore, the recording medium of this invention is considered as the composition which formed the recording layer at least on the glass substrate for recording media of above-mentioned this invention.
[0018]
[Function] In this invention, the intensity of a glass substrate, the endurance over breakage with the passage of time, etc. improve remarkably by controlling strictly three persons of compressive stress, tensile stress, and the depth of a compressive stress layer who arise when chemical strengthening of the glass substrate is carried out in the optimal range.
[0019] Moreover, the end face of a glass substrate is ground and improvement of endurance to intensity and breakage with the passage of time is further achieved by removing the crack used as causes, such as breakage with the passage of time.
[0020] This invention is explained in detail hereafter.
[0021] Three persons of compressive stress, tensile stress, and the depth of a compressive stress layer who arise when chemical strengthening of the glass substrate is carried out are strictly controlled by this invention in the optimal range.
[0022] The depth of the compressive stress layer produced on the glass substrate surface by chemical strengthening needs to be 30-100 micrometers.
[0023] The effect (shock resistance and vibration resistance nature) of chemical strengthening is too small in the depth of a compressive stress layer being less than 30 micrometers, and required intensity is not obtained. Moreover, if the depth of a compressive stress layer exceeds 100 micrometers, tensile stress will become large too much and intensity will fall.
[0024] As for the depth of the above-mentioned viewpoint to a compressive stress layer, it is desirable to be referred to as 30-200 micrometers, and it is still more desirable to be referred to as 50-100 micrometers.
[0025] The value of the compressive stress produced on a glass substrate surface by chemical strengthening needs to be 2-15kg/mm2 or less.
[0026] It becomes that the value of compressive stress is less than 2kg/mm2 with insufficient strength. Moreover, if the value of compressive stress exceeds 15kg/mm2, it will become superfluous [intensity] and will become easy to be divided.
[0027] As for the value of the above-mentioned viewpoint to compressive stress, it is desirable to consider it as 1-20kg/mm2, and it is still more desirable to consider it as 2-15kg/mm2.
[0028] The value of the tensile stress produced inside a glass substrate by chemical strengthening needs to be 1.5kg/mm2 or less.
[0029] It will become easy to destroy if the value of tensile stress exceeds 1.5kg/mm2.
[0030] As for the value of the above-mentioned viewpoint to tensile stress, it is desirable to consider it as 0.1-10kg/mm2, and it is still more desirable to consider it as 0.5-1.5kg/mm2.
[0031] Process in particular until it results in it is not restricted that there should just be a glass substrate for recording media of this invention within the optimal limits which three persons of compressive stress, tensile stress, and the depth of a compressive stress layer who arise when chemical strengthening of the glass

substrate is carried out mentioned above as a result, respectively.

[0032] What is necessary is to choose and control suitably glass composition and chemical-strengthening conditions (chemical-strengthening liquid, temperature, time, etc.), and just to perform chemical strengthening, for example, in order to control strictly three persons of compressive stress, tensile stress, and the depth of a compressive stress layer in the optimal range.

[0033] It will not be restricted especially if it is a chemical-strengthening method better known than before as the chemical-strengthening method. Chemical strengthening of a glass substrate immerses a glass substrate in the heated chemical-strengthening solution, for example, carries out ion exchange of the ion of a glass substrate surface with the ion in chemical-strengthening solution, and is performed.

[0034] Here, although the low temperature form ion exchange method, the high temperature form ion exchange method, the surface crystallizing method, the dealkalization method of the glass surface, etc. are known as an ion exchange method, it is desirable to use the low temperature form ion exchange method for performing ion exchange in the field which does not exceed glass transition temperature from a viewpoint of a glass transition point.

[0035] A low temperature form ion exchange method is a temperature region below the transition point Tg of glass, and is the method of replacing the alkali ion in glass by alkali ion with a larger ionic radius than it, making generate compressive stress strong against a glass surface by the increase in capacity of an ion exchange part, and strengthening a glass surface.

[0036] As chemical-strengthening solution, potassium nitrate (KNO_3), sodium nitrate ($NaNO_3$), Fused salt etc. is mentioned although the salt of ion, such as Cu, Ag, Rb, and Cs, was mixed in fused salt, such as potassium carbonate (K_2CO_3), the fused salt of the things (KNO_3+NaNO_3, $KNO_3+K_2CO_3$, etc.) which mixed these salt, or these salt. In addition, chemical-strengthening solution may be the solution of the above-mentioned salt instead of fused salt.

[0037] As for especially the cooking temperature of chemical-strengthening solution, it is desirable from viewpoints, such as ion exchange, that it is 300-400 degrees C 280-660 degrees C.

[0038] As for immersion time, it is desirable to consider it as several hours - tens of hours.

[0039] In addition, before a glass substrate is immersed in fused salt, for the purpose reason of pre-heating, it is desirable to preheat a glass substrate at 100-300 degrees C. Moreover, let the glass substrate after chemical strengthening be a product through cooling, a cleaning process, etc.

[0040] It will not be restricted especially if it is the glass substrate in which chemical strengthening is possible as a glass substrate. Moreover, the size of a glass substrate, thickness in particular, etc. are not restricted.

[0041] In addition, as for the thickness of a glass substrate, about 0.3-20mm is desirable, and its about 0.5-1.0mm is still more desirable. Required intensity is not obtained as the thickness of a glass substrate is less than 0.3mm. Moreover, when the thickness of a glass substrate exceeds 20mm, there is no necessity of applying this invention.

[0042] As construction material of a glass substrate, for example Alumino silicate glass, soda lime glass,

Glass ceramics, such as soda aluminosilicate glass, aluminoborosilicate glass, BOROSHIRIKETO glass, silica glass, chain silicate glass, or glass ceramics, etc. is mentioned. In addition, especially since alumino silicate glass is excellent in shock resistance or vibration resistance nature, it is desirable.

[0043] As alumino silicate glass while containing 2:5.5 to 15 weight % of ZrO(s) as the main ingredients 2:62 to 75 weight % of SiO(s), Al2O3:5-15 weight %, Li2O:4-10 weight %, and Na2O:4-12weight % The glass for chemical strengthening whose bulk densities of 0.5-2.0, and Al2O3/ZrO2 the bulk density of Na2 O/ZrO2 is 0.4-2.5 is desirable.

[0044] moreover, in order to lose the projection on the surface of a glass substrate which the non-dissolved object of ZrO2 produces owing to It is desirable to use the glass for chemical strengthening which contains Al2O3 for ZnO2 0 to 2.8% 57 to 74%, and contains [SiO2] Na2O for LiO2 4 to 14% 7 to 16% 3 to 15% by a mol % displays.

[0045] Such alumino silicate glass is excellent in anti-chip box intensity and a heat-resisting property while it is excellent in the balance of three persons of compressive stress, tensile stress, and the depth of a compressive stress layer by carrying out chemical strengthening, and it maintains flat nature while it does not have the deposit of Na, even if it is under hot environments, and it is excellent also in Knoop hardness.

[0046] It is desirable to grind the end face of a glass substrate and to remove the crack used as causes, such as breakage with the passage of time, in the glass substrate for recording media of this invention mentioned above, in this invention.

[0047] Here, the end face of a glass substrate refers to portions other than the main surface (field in which a recording layer is formed) of a glass substrate, and refers to a peripheral end face (a side wall part and a chamfering-of-the-edge part are included) and an inner circumference end face (a side wall part and a chamfering-of-the-edge part are included).

[0048] The polish method in particular of the end face of a glass substrate is not restricted, but the well-known polish method can be used for it.

[0049] As the polish method, mechanical polishing, such as polish by scouring pads (abrasive powder), such as brushing, an elasticity polisher, and a hard polisher, and polish by abrasive powder (abrasive grain etc.), etc. is mentioned, for example. In addition, since the mirror plane of required surface roughness is acquired, these mechanical polishing can be carried out, combining suitably mechanical polishing which different-** mechanical polishing of a different kind, a kind, particle diameter of a polisher, etc.

[0050] Here, as an elasticity polisher, a thing made from suede and velour etc. is mentioned, for example, and hard velour, urethane firing, pitch sinking-in suede, etc. are mentioned as a hard polisher, for example. Moreover, cerium oxide (CeO2), alumina (gamma-Al2O3), iron oxide red (Fe2O3), chrome oxide (Cr2O3), zirconium oxide (ZrO2), titanium oxide (TiO2), etc. are mentioned as abrasive powder.

[0051] Polish of the end face of a glass substrate may be performed after grinding of a glass substrate and which process of a polish process, or you may carry out after each process. Grinding of a glass substrate and the process of polish are usually roughly divided, and consist of each process of (1) roughness shear (rough grinding), (2) sand credit (energy grinding, wrapping), the (3) first polish (PORISSHU), and the (4)

second polish (final polish, PORISSHU).
[0052] You may perform the polish process of the end face of a glass substrate after a sand credit (energy grinding, wrapping) process or the first polish (PORISSHU) or the second polish (final polish, PORISSHU) process, for example besides carrying out after a rough shear (rough grinding) process. When mirror surface finish of a glass substrate end face is performed before a lapping process, a glass substrate end face may become coarse a little with the sand of a lap in the case of a lapping process.
[0053] As for the polishing quantity (polish depth) of the end face of a glass substrate, it is still more desirable to adjust suitably from a viewpoint of the crack clearance which has on breakage with the passage of time etc.
[0054] The surface roughness of the end face of a glass substrate from a viewpoint of preventing a development of the foreign substance resulting from an end face preferably Rmax:0.01-2micrometer and less than [Ra:0.001-1micrometer] -- further -- desirable -- Rmax:0.01-1micrometer and Ra: -- 0.001-0.8 micrometers is Rmax:0.01-1micrometer and Ra:0.001-0.5micrometer above more preferably.
[0055] When taking a glass substrate in and out of a stowage container by making surface roughness of the end-face portion of a glass substrate into the mirror plane of the above-mentioned range, the particle generated when a glass substrate becomes slanting and a container is contacted can be stopped effectively.

[0056] Moreover, by making surface roughness of the end-face portion of a glass substrate into the mirror plane of the above-mentioned range, the particle leading to thermal asperity (Thermal Asperity) does not occur, and lowering of the regenerative function by thermal asperity can be prevented. An effect is remarkable for the magnetic recording medium especially reproduced with a magnetic reluctance type head.

[0057] The glass substrate for recording media of this invention mentioned above can be used also as the glass substrate for magneto-optical discs besides the glass substrate for magnetic recording media, and disk boards for electron optics, such as an optical disc.
[0058] Next, the recording medium of this invention is explained.
[0059] The recording medium of this invention forms a recording layer at least on the glass substrate for recording media of above-mentioned this invention.
[0060] Since the glass substrate for recording media excellent in intensity and the endurance over breakage with the passage of time is being used for the recording medium of this invention, it is excellent in intensity and the endurance over breakage with the passage of time, and has high reliability.
[0061] Here, the magnetic recording medium which is an example of a recording medium is explained. On the glass substrate for magnetic disks, a magnetic recording medium laminates a foundation layer, a magnetic layer, a protective layer, and a lubricating layer one by one, and usually manufactures them.
[0062] A magnetic recording medium has predetermined flatness and surface roughness, on the glass substrate for magnetic disks which performed surface chemical strengthening treatment, laminates a foundation layer, a magnetic layer, a protective layer, and a lubricating layer one by one, and usually

manufactures them.

[0063] The foundation layer in the magnetic recording medium of this invention is chosen according to a magnetic layer.

[0064] As a foundation layer, the foundation layer which is chosen from non-magnetic metal, such as Cr, Mo, Ta, Ti, W, V, B, and aluminum, and which consists of material more than a kind at least is mentioned, for example. In the case of the magnetic layer which uses Co as the main ingredients, it is desirable that it is Cr simple substance from a viewpoint and the Cr alloy of the superiors for magnetic property. Moreover, a foundation layer cannot be restricted but can also be used as a lamina with two or more layer structure which laminated the layer same or of a different kind. For example, multilayer foundation layers, such as Cr/Cr, Cr/CrMo, Cr/CrV, CrV/CrV, aluminum/Cr/CrMo, aluminum/Cr/Cr, aluminum/Cr/CrV, and aluminum/CrV/CrV, etc. are mentioned.

[0065] The material in particular of the magnetic layer in the magnetic recording medium of this invention is not restricted.

[0066] As a magnetic layer, magnetic thin films, such as CoPt, CoCr, CoNi, CoNiCr, CoCrTa, CoPtCr and CoNiPt which use Co as the main ingredients, and CoNiCrPt, CoNiCrTa, CoCrTaPt, CoCrPtSiO, are mentioned, for example. A magnetic layer is good also as multilayer composition (for example, CoPtCr/CrMo/CoPtCr, CoCrTaPt/CrMo/CoCrTaPt, etc.) which divided the magnetic film by nonmagnetic membranes (for example, Cr, CrMo, CrV, etc.), and aimed at abatement of the noise.

[0067] The thing which made the oxide of the impurity elements chosen as Co system alloy from Y, Si, rare earth elements, Hf, germanium, Sn, and Zn or these impurity elements contain as a magnetic layer corresponding to a magnetic reluctance type head (magnetoresistive head) or a large-sized magnetic reluctance type head (GMR head) is contained.

[0068] Moreover, you may be GURANYURA of the structure where magnetic particles, such as Fe, Co, FeCo, and CoNiPt, were distributed as a magnetic layer in the nonmagnetic membrane which consists of a ferrite system besides the above, an iron-rare earth system, SiO2, BN, etc. Moreover, magnetic layers may be an inner surface type and which a vertical type record form.

[0069] The protective layer in particular in the magnetic recording medium of this invention is not restricted.

[0070] As a protective layer, a Cr film, a Cr alloy film, a carbon film, a zirconia film, silica membrane, etc. are mentioned, for example. These overcoats can be continuously formed with an in-line type sputtering system with a foundation layer, a magnetic layer, etc. Moreover, these overcoats are good also as multilayer composition which consists of a film same or of a different kind well also as a lamina.

[0071] In this invention, it may change to the above-mentioned protective layer top or the above-mentioned protective layer, and other protective layers may be formed. For example, it changes to the above-mentioned protective layer, and colloidal silica particulates may be distributed and applied to the inside which diluted the tetra-alkoxy run with the solvent of an alcoholic system on the Cr film, it may calcinate to it further, and a silicon-oxide (SiO2) film may be formed in it.

[0072] The lubricating layer in particular in the magnetic recording medium of this invention is not restricted.

[0073] A lubricating layer dilutes the perphloro polyether (PFPE) which is a fluid lubrication agent with solvents, such as an Freon system, for example, applies it to the medium surface by the dipping method, the spin coat method, and the spray method, if needed, heat-treats and is formed.
[0074]
[Working example] Based on a work example, this invention is explained still more concretely hereafter.
[0075] A work example 1 [0076] [manufacture (1) ******** of a glass substrate / glass / which was formed by the down draw method / sheet] first The grinding process of the glass substrate which consists of diameter 96mmphi and 3-mm-thick alumino SHIRIKEITO glass cut down disc-like with a grinding wheel was carried out by the comparatively coarse diamond wheel, and it was fabricated in diameter 96mmphi and thickness of 1.5mm. In this case, instead of the down draw method, the direct press of the melting glass may be carried out using a punch, a bottom part, and a barrel type, and a disc-like vitreous humour may be obtained.
[0077] As alumino SHIRIKEITO glass, are a mol % displays and SiO2 In addition, 57 to 74%, Glass for chemical strengthening which contains LiO2 for Al2O3 3 to 15% 0 to 2.8%, and contains [ZnO2] 4 to 14% for Na2O as the main ingredients 7 to 16% (for example, [a mol % displays]) LiO[SiO2:67.0%, ZnO2:1.0%, Al2O3:9.0%, and]2:12.0%, Na2O: The glass for chemical strengthening which contains 10.0% as the main ingredients was used.
[0078] Subsequently, the one side [every] grinding process of both sides of the above-mentioned glass substrate was carried out by the diamond wheel whose grain size is finer than the above-mentioned grinding stone. The load at this time was about 100kg. This made about 10 micrometers to the surface roughness of glass substrate both sides by Rmax (it measures by JIS B 0601).
[0079] Next, while opening the pore in the center portion of a glass substrate using the cylindrical grinding stone, after also grinding the peripheral end face and setting a diameter to 95mmphi, predetermined beveling processing was performed to a peripheral end face and inner skin. The surface roughness of the glass substrate end face at this time was about 4 micrometers in Rmax.
[0080] (2) While ********** more nearly subsequently ground the end face of the glass substrate by brushing, rotating a glass substrate, it was ground so that the surface roughness of an end face might be set to 1 micrometer by Rmax and might be set to about 0.3 micrometer by Ra.
[0081] Water washing of the surface of the glass substrate which finished the above-mentioned end polishing processing was carried out.
[0082] (3) Sand credit processing was performed to the sand credit (wrapping) process, next the glass substrate. This sand credit process aims at improvement in dimensional accuracy and accuracy of form. Sand credit processing was performed using wrapping equipment, and the grain size of the abrasive grain was changed to #400 and #1000, and was performed twice.
[0083] Both sides of the glass substrate stored in the carrier were wrapped at the profile irregularity of 0-1 micrometer, and about 6 micrometers of surface roughness (Rmax) by using the alumina abrasive grain of grain size #400, setting Load L as about 100kg first, in detail, and rotating an adduction reduction gear and an abduction reduction gear.

[0084] Subsequently, it wrapped by having changed the grain size of the alumina abrasive grain to #1000, and was considered as about 2 micrometers of surface roughness (Rmax).
[0085] The glass substrate which finished the above-mentioned sand credit processing was immersed in each cleaning tank of neutral detergent and water one by one, and was washed.
[0086] (4) The first polish process, next the first polish process were given. This first polish process aims at clearance of the crack which remained at the sand credit process mentioned above, or distortion, and was performed using polish equipment.
[0087] The first polish process was carried out on the following polish conditions in detail, using a hard polisher (cerium pad MHC15: made by a speed femme company) as a polisher (abrasive powder).
[0088] grinding liquid: -- cerium oxide + water load: -- 300g/cm2 (L= 238kg)
29 rpm [0089] polish time: -- amount of 15-minute clearances: -- number of 30-micrometer lower lapping plate rotations: -- number of 40 rpm upper lapping plate rotations: -- number of the reduction-gear rotations in 35 rpm: -- number of the reduction-gear rotations outside 14 rpm: -- The glass substrate which finished the above-mentioned first polish process was immersed in each cleaning tank of neutral detergent, pure water, pure water, and IPA (isopropyl alcohol) and IPA (steamy dryness) one by one, and was washed.
[0090] (5) Using the polish equipment used at the second polish process, next the first polish process, the polisher was changed to the elasticity polisher (Pori Lux: made by a speed femme company) from the hard polisher, and the second polish process was carried out. It was presupposed except polish conditions having carried out 100g/cm2 and polish time, and having set the amount of clearances to 5 micrometers for load for 5 minutes that it is the same as that of the first polish process.
[0091] The glass substrate which finished the above-mentioned second polish process was immersed in each cleaning tank of neutral detergent, neutral detergent, pure water, pure water, and IPA (isopropyl alcohol) and IPA (steamy dryness) one by one, and was washed. In addition, the ultrasonic wave was impressed to each cleaning tank.
[0092] (6) Chemical strengthening was performed to the glass substrate which finished a chemical-strengthening process next the above-mentioned grinding, and a polish process. Chemical strengthening prepared the chemical-strengthening solution which mixed potassium nitrate (60%) and sodium nitrate (40%), heated this chemical-strengthening solution at 400 degrees C, immersed the washed glass substrate preheated by 300 degrees C for about 3 hours, and was performed. In order to carry out chemical strengthening of the whole surface of a glass substrate in the case of this immersion, it carried out in the state where it stored in the electrode holder so that two or more glass substrates might be held by an end face.
[0093] Thus, by carrying out immersion processing at chemical-strengthening solution, the lithium ion of a glass substrate surface and sodium ion are replaced by the sodium ion in chemical-strengthening solution, and potassium ion, respectively, and a glass substrate is strengthened.
[0094] The glass substrate which completed the above-mentioned chemical strengthening was immersed in the 20-degree C cistern, was quenched, and was maintained for about 10 minutes.

[0095] The glass substrate which finished the above-mentioned quenching was immersed in the sulfuric acid heated at about 40 degrees C, and it washed, applying an ultrasonic wave.
[0096] Surface roughness Ra on the surface of main of a glass substrate pass the above-mentioned process was 0.5-1nm.
[0097] Moreover, about the glass substrate (eight sheets) pass the same process as the above, when compressive stress, tensile stress, and the depth of the compressive stress layer were measured, respectively, it became the value shown in Table 1.
[0098] The stress-distribution figure (profile of distortion) created based on the above-mentioned measurement result (average) is shown in drawing 1 .
[0099]
[Table 1]

	圧縮応力		圧縮応力層の深さ		引張応力	
	実施例1	比較例1	実施例1	比較例1	実施例1	比較例1
	7.60	28.25	46.9	131.6	0.56	8.58
	6.07	28.19	65.7	140.8	0.52	8.72
	6.61	29.70	70.4	140.8	0.79	8.59
	6.01	29.01	51.6	131.5	0.58	8.19
	9.89	31.22	65.7	145.5	0.76	9.46
	9.49	32.39	61.0	145.5	1.14	10.29
	7.13	28.04	65.7	136.2	0.74	8.21
	9.26	17.66	46.9	173.7	0.84	8.66
		27.39		140.8		8.15
		27.77		117.4		8.65
平均	7.75	27.96	59.2	140.4	0.74	8.75

[0100] [the process in which the magnetic disk carried out manufacture **** / both sides of the glass substrate for magnetic disks pass] Using the in-line-type sputtering system, the texture layer by the weld slag of AlN, Cr foundation layer, the CrMo foundation layer, the CoPtCrTa magnetic layer, and C protective layer were formed one by one, and the magnetic disk was obtained.
[0101] When the breakdown test by a high velocity revolution, the breakdown test by drop, and durability test to breakage with the passage of time were carried out about the obtained magnetic disk, neither destruction nor breakage was accepted.
[0102] In addition, when the glide test was carried out about the obtained magnetic disk, neither a hit (a head should graze to the projection on the surface of a magnetic disk) nor crash (a head should collide with the projection on the surface of a magnetic disk) was accepted.
[0103] The measured value of comparative example 1 compressive stress, tensile stress, and the depth of a compressive stress layer manufactured the glass substrate for magnetic disks (eight sheets) which is the value shown in Table 1, and manufactured the magnetic disk using this substrate. Moreover, the stress-

distribution figure (profile of distortion) created based on the above-mentioned measured value (average) is shown in drawing 1 .

[0104] Destruction and breakage were accepted when the breakdown test by a high velocity revolution, the breakdown test by drop, and durability test to breakage with the passage of time were carried out about the obtained magnetic disk.

[0105] [work-example 2 glass composition] while containing 2:5.5 to 15 weight % of ZrO(s) as the main ingredients 2:62 to 75 weight % of SiO(s), Al2O3:5-15 weight %, Li2O:4-10 weight %, and Na2O:4-12weight % The bulk density of Na2 O/ZrO2 obtained the glass substrate for magnetic disks, and the magnetic disk like the work example 1 except the bulk density of 0.5-2.0, and Al2O3/ZrO2 having considered it as the alumino silicate glass which is 0.4-2.5.

[0106] As a result of doing the examination same about the obtained magnetic disk as a work example 1, neither destruction nor breakage was accepted.

[0107] The glass substrate for magnetic disks and the magnetic disk were obtained like the work example 1 except having used soda lime glass (work example 3) and soda aluminosilicate glass (work example 4) instead of a work example 3 - 4 alumino silicate glass.

[0108] As a result of doing the examination same about the obtained magnetic disk as a work example 1, neither destruction nor breakage was accepted.

[0109] The foundation layer which becomes both sides of the glass substrate for magnetic disks obtained in the work-example 5 work example 1 from aluminum (50A of thickness)/Cr(1000A)/CrMo (100A), The magnetic layer and Cr (50A) protective layer which consist of CoPtCr(120A)/CrMo(50A)/CoPtCr (120A) were formed with the in-line type sputtering system.

[0110] The above-mentioned substrate is dipped in the organic silicon compound solution (mixed liquor of water, IPA, and tetra-ethoxy silane) which distributed silica particulates (grain size of 100A). By calcinating, the protective layer with the texture function which consists of SiO2 was formed, dip processing of this protective layer top was further carried out to the lubricant which consists of perphloro polyether, the lubricating layer was formed, and the magnetic disk for magnetoresistive heads was obtained.

[0111] When the breakdown test by a high velocity revolution, the breakdown test by drop, and durability test [as opposed to / reach and / breakage with the passage of time] were carried out about the obtained magnetic disk, neither destruction nor breakage was accepted.

[0112] The magnetic disk for thin film heads was obtained like the work example 5 except having made work-example 6 foundation layer into aluminum/Cr/Cr, and having set the magnetic layer to CoNiCrTa.

[0113] It was checked that it is the same as that of a work example 5 about the above-mentioned magnetic disk.

[0114] Although the desirable work example was given above and this invention was explained, this invention is not necessarily limited to the above-mentioned work example.

[0115] For example, the kind of recording layers, such as a kind of glass substrate and a magnetic layer, is not limited to the thing of a work example.

[0116]
[Effect of the Invention] As explained above, in this invention, the intensity of a glass substrate, the endurance over breakage with the passage of time, etc. improve remarkably by controlling strictly three persons of compressive stress, tensile stress, and the depth of a compressive stress layer who arise when chemical strengthening of the glass substrate is carried out in the optimal range.
[0117] Moreover, the end face of a glass substrate is ground and improvement of endurance to intensity and breakage with the passage of time is further achieved by removing the crack used as causes, such as breakage with the passage of time.

[Translation done.]